DEVICE FOR TWO-DIMENSIONAL LOCALIZATION OF EVENTS THAT GENERATE CURRENT ON A RESISTIVE SURFACE

FIELD OF THE INVENTON

The present invention relates to a device for two-dimensional localization of events that generate current on a resistive surface.

More particularly, the invention provides a device of the type comprising electrodes fixed around the resistive surface in order to pick up currents generated by injecting current or electric charge at points on the resistive surface, together with a circuit connected to the electrodes for generating signals based on the picked-up currents and representative of the co-ordinates of said points in a predetermined co-ordinate system.

Position detectors for two-dimensional localization of current-generating events, e.g. particle impacts on wires which may optionally be amplified by electromagnetic cascades, or injections of electric charge by contact or by induction, have applications in numerous fields such as astronomy, crystallography, medical nuclear imaging, and computerized graphics devices using digitizer pads or direct pointing on a screen (if the device is transparent).

One of the main difficulties encountered in making localization devices of the above type is obtaining a linear relationship between the generated signals representing the coordinates of the locations of events, and the real values of said co-ordinates, so as to be able to provide an undistorted image of event locations.

BACKGROUND OF THE INVENTION

French patent application No. 2 463 955 describes a localization device using a rectangular resistive plate provided with contacts disposed along its sides. The electrical contacts situated along a single side are connected to a corresponding common summing line via respective resistances. The summing lines associated with two opposite sides are connected to the inputs of a differential circuit which delivers an analog signal representative of one of the two co-ordinates of the point at which the electrical charge was injected which gave rise to the currents picked-up by the various contacts. The summing lines associated with the other two sides are connected to the inputs of another differential circuit which delivers an analog signal representative of the other co-ordinate of the point.

A special selection of resistance values connecting the contact points to the summing lines makes it possible to minimize distortion but does not avoid it altogether.

Japanese patent application published under the No. 58-99889 also describes a localization device using a rectangular resistive plate provided with electrical contacts connected to summing lines via particular resistances. In order to reduce distortion, resistances are inserted between the electrical contacts situated on two adjacent sides of the plate, in particular between contacts close to the corners of the plate.

Here again, although distortion is reduced, it nevertheless remains significant.

Another technique for eliminating distortion consists in converting the amplitudes of the currents picked up by the electrodes into digital form (optionally after summation and normalization) and then in using computer means to process the digital values obtained in order to correct for the distortion. It is relatively expensive to use computer means in this way and, in some applications, the delay resulting from processing time can be particularly troublesome. Further, distortion varies over time and with environmental conditions. The function for correcting a particular nonlinearity at a given instant need not be valid later on.

In order to reduce nonlinearity, proposals have also been made to use specially-shaped electrodes. However nonlinearity is not completely eliminated. Computer processing is still required to correct distortion with the same drawbacks as mentioned above together with the additional difficulty of making the specially-shaped electrodes.

The present invention seeks to provide a localization device which supplies signals representative of an undistorted image without requiring cmputer processing or particularly complicated electrodes.

SUMMARY OF THE INVENTION

This aim is achieved by means of a device for two-dimensional localization of current-generating events on a resistive surface, the device comprising:

a resistive surface;

a plurality of electrodes fixed to the resistive surface around its periphery in order to pick up currents generated by injecting current or electric charge into points on the resistive surface; and

at least three current summing lines connected to the electrodes via discrete resistive components in such a manner as to obtain analog signals on said summing lines whose amplitudes are functions of the co-ordinates of said points in a predetermined reference co-ordinate system;

the device including the improvement whereby:

each of said electrodes is connected by means of respective resistive components to at least three summing lines in such a manner that at least two of the said lines deliver analog signals whose amplitudes are substantially linear functions of the desired co-ordinates.

The fact of connecting each electrode to at least three summing lines is an essential characteristic of the invention since it is a necessary condition for obtaining at least two signals which are linear or quasi-linear functions of the looked-for co-ordinates, i.e. for having undistorted position information directly available in analog form. Taking the minimum case of three summing lines, the currents picked up by the electrodes split into three fractions: first fractions which are combined by a first summing line to provide a current whose magnitude is a linear function of both co-ordinates (or of a first one of the two co-ordinates); second fractions which are combined by a second summing line and provide a current whose magnitude is a linear function of both co-ordinates (or of the second co-ordinate); and third fractions which constitute excess fractions of the currents picked up by the electrodes and which are removed by the third summing line, e.g. to ground.

A localization device in accordance with the invention is thus distinguished from prior art devices making use of summing lines and in which each electrode is connected via a resistance to one, or at most to two, summing lines. Given the above explanation, the fact that each electrode is not connected to a third summing line makes it impossible to get rid of the excess fraction of current picked up by the electrode, thereby necessarily giving rise to distortion.